The effect of a mono component serine protease and different AMEn levels in broiler diets on growth performance from 1 to 18 days of age

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Objective

The objective of the present study was to evaluate the effect of the inclusion of a mono component serine protease (RONOZYME ProAct, DSM Nutritional Products) in diets with two different AMEn contents on apparent ileal digestibility (AID) of amino acids (AA) and growth performance in broilers from 1 to 18 days of age.

Material and methods

A total of 720 one-d-old straight-run broiler chicks (Ross 308), with an initial BW of 40.3 ± 1.02 g were obtained from a commercial hatchery (Avimosa S.A., Madrid, Spain). On arrival at the experimental station, birds were randomly allocated to floor pens (1.5m x 1.0 m) in a windowless, environmentally controlled room. Each pen contained 30 birds with fresh wood shavings as bedding a bell drinker and a tube feeder. Room temperature was maintained at 33°C during the first 3 d of life and then, was reduced gradually according to age until reaching 24°C at 21 d of age. Chicks had free access to feed and water throughout the trial. The experimental diets were formulated according to Fundación Española Desarrollo Nutrición Animal (2010) tables of ingredient composition and met or exceeded the nutrient requirement recommended by Fundación Española Desarrollo Nutrición Animal (2008) for broilers diets. All diets were based on wheat, barley, soybean meal and sunflower meal and were presented in crumble form. Titanium dioxide was added at 0.5% to all diets as an indigestible marker. The experiment was conducted as a completely randomized design with 4 treatments arranged factorially with or without protease supplementation (0 and 200 mg/kg) and two AMEn levels (3,000 and 2,950 kcal/kg of diet). Each treatment was replicated 6 times and the experimental unit was a pen with 30 birds. Body weight and feed consumption were determined by pen weekly from 1 to 18 d of age. Mortality was recorded continuously and birds that died were autopsied to determine the possible causes of death. From this data body weight gain (BWG), average daily feed intake (ADFI), and feed conversion ratio (FCR) corrected for mortality were calculated per pen by period and cumulatively. At 18 d of age, 10 chicks per pen were chosen at random and allocated to battery cages (1.0 m x 0.9 m) in a windowless, environmentally controlled room. The cages had wire flooring and were equipped with 2 nipple drinkers and one open trough feeder. Bird management was similar to that of the floor house. Each treatment was replicated 6 times and the experimental unit was a cage with 10 birds. At 21 d of age, all chicks were euthanized by CO_2 inhalation and the lower half of the ileum was used for digesta sampling according to the method of Ravindran et al. (1999). The ileal digesta of all birds from each pen was collected by gently flushing the contents with distilled water into plastic containers. Samples were pooled and immediately frozen at - 20°C. After de-frosting samples were freeze-dried, ground with a mixer mill (Model MM 400, Retsch GmbH, Haan, Germany) and stored in airtight containers at room temperature until chemical analysis. The AID of the nutrients was calculated according to the following formula:

$$\text{AID}\ (\%) = 100\ \text{x} \left(1 - \frac{[\text{Marker}]\text{in diet}}{[\text{Marker}]\text{in Ileal digesta}}\ \text{x}\ \frac{[\text{Nutrient}]\text{in Ileal digesta}}{[\text{Nutrient}]\ \text{in diet}}\right)$$

Where:

[Marker] in ileal digesta: Concentration of Titanium dioxide in ileal digesta.

[Marker] in diet: Concentration of Titanium dioxide in diet.

[Nutrient] in diet: Nutrient concentration in diet.

[Nutrient] in Ileal digesta: Nutrient concentration in ileal digesta.

The data was analyzed as a completely randomized design using the Proc GLM procedure of Statistical Analysis Systems Institute (1990). The model included protease inclusion and AMEn energy content of the diet as main effects, as well as the interaction. An α value of < 0.05 was considered a significant difference and an α value of < 0.10 was considered a tendency. No significant interactions between AMEn and protease inclusion were detected for any of the traits studied and therefore, only main effects are presented.

Results

From 1 to 7 d of age, chicks fed diets without protease supplementation had higher ADFI (23.5 vs. 22.9 kg; $P < 0.05$) and poorer FCR (1.09 vs. 1.06; $P < 0.01$) than chicks fed diets with protease supplementation (Table 1). However, BWG was not affected by the inclusion of the protease. Also, from d 14 to 18 protease inclusion improved FCR by 2.08% although the difference was not significant. The AMEn content of the diet had no effect on any of the growth performance traits studied. From 7 to 14 d of age, chicks fed low energy diets tended to have worse FCR (1.26 vs. 1.24; $P < 0.01$) than chicks fed the high energy diets, but BWG and ADFI were not affected. From 14 to 18 d of age, energy content of the diet did not affect growth performance. Cumulatively (1 to 18 d of age), the AMEn content of the diet did not affect BWG and ADFI, but chicks fed the low energy diets tended to have poorer FCR (1.23 vs. 1.20; $P < 0.10$) than chicks fed the high energy diets. No differences in AA digestibility were detected among treatments although numerically, chicks fed diets supplemented with protease showed higher AID for most indispensable AA and of cysteine (Table 2).

Table 1. Influence of protease (RONOZYME® ProAct) inclusion and energy level of the diet on productive performance of broilers from 1 to 18 d of age

		1-7 d			7-14 d			14-18 d			1-18 d	
	BWG[1]	ADFI[2]	FCR[3]	BWG	ADFI	FCR	BWG	ADFI	FCR	BWG	ADFI	FCR
AMEn Protease												
Low Without	21.4	23.4	1.10	45.2	56.4	1.25	57.5	83.3	1.45	40.4	49.5	1.22
With	21.6	23.1	1.07	44.2	55.8	1.26	56.9	81.4	1.43	39.7	48.8	1.23
High Without	21.7	23.6	1.09	45.2	55.9	1.24	56.8	81.4	1.44	40.3	49.0	1.21
With	21.4	22.7	1.06	44.7	55.5	1.24	59.0	82.1	1.39	40.8	48.6	1.19
SEM[4] (n=6)	0.25	0.23	0.009	0.47	0.55	0.009	0.94	0.89	0.019	0.41	0.41	0.011
AMEn												
Low	21.5	23.0	1.08	44.7	56.1	1.26	57.2	82.4	1.44	40.1	49.1	1.23
High	21.5	23.1	1.07	45.0	55.7	1.24	57.9	81.8	1.41	40.6	48.8	1.20
Protease												
Without	21.5	23.5	1.09	45.2	56.1	1.24	57.1	82.4	1.44	40.4	49.3	1.22
With	21.6	22.9	1.06	44.5	55.6	1.25	57.9	81.8	1.41	40.2	48.7	1.21
SEM (n=12)	0.18	0.16	0.007	0.33	0.39	0.006	0.67	0.63	0.013	0.29	0.29	0.008
Effect	Probability											
AMEn	0.7671	0.7191	0.3377	0.5315	0.4833	0.0701	0.4206	0.5259	0.1572	0.2366	0.4383	0.0524
Protease	0.9737	0.0138	0.0053	0.1353	0.3649	0.1954	0.4109	0.4910	0.1347	0.7483	0.1894	0.4997
AMEn×Protease	0.3786	0.1601	0.7915	0.6258	0.8926	0.5723	0.1554	0.1525	0.5118	0.1700	0.6177	0.2654

[1] Body weight gain (g/d).

[2] Average daily feed intake (g).

[3] Feed conversion ratio.

[4] Standard error of the means (6 replicates of 30 birds each).

Table 2. Influence of protease (RONOZYME® ProAct) inclusion and energy level of the diet on apparent ileal digestibility (AID) of nutrients of broilers at 21 days of age

		AID of nutrients					
		CP[1]	Met	Cys	Lys	Trp	Thr
AMEn	Protease						
Low	Without	79.48	90.47	70.17	83.89	82.25	75.57
	With	80.09	90.19	71.08	84.78	81.26	76.40
High	Without	79.58	89.30	67.18	82.75	81.97	73.58
	With	79.07	90.46	69.52	83.57	81.82	74.88
SEM[3] (n=6)		0.744	0.625	1.334	0.760	0.680	1.117
AMEn							
Low		79.78	90.32	70.67	84.33	81.86	75.99
High		79.32	89.83	68.35	83.11	81.88	74.23
Protease							
Without		79.53	89.83	68.54	83.37	82.14	74.57
With		79.58	90.31	70.30	84.30	81.59	75.64
SEM (n=12)[2]		0.430	0.361	0.770	0.439	0.393	0.645
Effect		Probability					
AMEn		0.5967	0.5021	0.1128	0.1722	0.8562	0.1777
Proact		0.9573	0.5116	0.2503	0.3125	0.4604	0.4056
AMEn × Protease		0.5203	0.2884	0.6062	0.9677	0.5875	0.8529

[1] Crude protein.

[2] Standard error of the means (6 replicates of 10 birds each).

Conclusions

In this study protease supplementation decreased feed intake and improved feed conversion ratio. Productive performance of birds improved for the first week of age but the effect was less in older birds. An increase in the energy content of the diet improved feed conversion ratio from 1 to 18 d of age. Protease supplementation or energy content of the diet did not affect significantly AID of the AA although broilers fed the protease showed numerically higher AID for most indispensable AA and cysteine than broilers fed the control diet. It is concluded that the inclusion of the protease in the feed can improve productive performance of young broilers.

References

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